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inferior internal connecting or bridging convolution visible superficially, and completely separating the parieto-occipital from the calcarine, etc.

JANUARY 22.

The President, Dr. **RUSCHENBERGER**, in the chair.

Thirty-six members present.

The death of Edward Tatnall, Jr., was announced.

Habits and Intelligence of Vespa maculata.—Mr. **THOMAS MEEHAN** exhibited young branches of *Fraxinus excelsior*, and of the common lilac, which had been stripped of their bark during the summer by the large yellow hornet. The insects had been carefully watched at the work. They visited these trees in large numbers, and carried the strips of bark away in their mouths. For what purpose they used the bark could not well be ascertained. It was generally supposed that they collected the matter from which their huge nests of paper-like material were made, from fences and other dead woody matter. He thought it remarkable that the insect should collect from plants of the same natural order only, as far as careful examination of other plants in the vicinity could decide. This hornet, he observed, was gifted with great intelligence ; on an occasion he had observed one with a summer locust, several times its own size, endeavoring to rise with it from the ground and fly away, but failed from the great weight of the locust. It then walked with its prey about thirty feet to a tall maple, which it ascended to the top, and then flew off with its burden in a horizontal direction. There was more than instinct in this act. There was reasoning on certain facts and judgment accordingly, and the insect's judgment had proved correct.

JANUARY 29.

The President, Dr. **RUSCHENBERGER**, in the chair.

Forty-seven members present.

A paper, entitled "On the Association of Grossularite, Zoisite, Heulandite, and Leidyite, a new Species," by Geo. A. Koenig, was presented for publication.

The Mode of Recognition among Ants.—The following statements were made by Mr. **McCOOK** of certain tentative experiments upon two species of ants, as to the mode of recognizing each other, and distinguishing fellow formicarians from congeners of alien nests.

Every dweller within town walls is familiar with the little creatures popularly known (in some quarters at least) as the "pavement ants," and known in myrmecology under the name of *Tetramorium cæspitum.* Early in the spring, as soon as the season has gathered a comfortable degree of warmth, these insects are seen issuing from the gravel or soil of garden walks, or from the earthen seam that binds together the bricks of the pavement. Around the openings whence the ants issue, are seen small circular mounds of sand or soil which have been accumulated by the out-bringing, one by one, of the particles of earth. But the chief notoriety of these ants, not unlike their fellow-creatures of the *genus homo*, is due to their martial instincts. Hundreds, even thousands, of them are often seen waging battle with great ferocity and persistence. One battle, which was noted close by the wall, within the inclosure of a church on Broad Street and Penn Square, was prolonged for a period of two weeks and several days. At least the same spot, during that period, whenever observed, showed always the same phenomena of a battle-field, the contestants of which were apparently the same. Two points of great interest have arisen concerning these Amazonian emmets—for they are veritable Amazons, the warriors being composed wholly of the *workers* or *neuters*, who are undeveloped females.

First, why do they fight at all? They are of one species, apparently of one formicary or nest. The very first act upon issuing from the winter quarters is to engage in this war, which is often well nigh a war of extermination on both sides. Frequently throughout the season these hostilities are renewed. If the individuals be of one formicary, we may conjecture that this is nature's mode of either distributing the species from the home-centre, by causing the worsted party to emigrate; or, if the combatants be of separate, adjoining communities, a sort of emmetonian Malthusianism (if one may coin such a phrase), by which the surplus population is reduced and kept within due bounds, much to the future comfort of the survivors, and more to the satisfaction of man. This is, of course, only conjecture.

A second question arises, even more interesting and more perplexing, viz., How do the combatants recognize friend from foe? They are all alike—indeed *more* alike than "peas in a pod," as the proverb goes. Take a group of combatants into the hand, put them under a magnifier; the most careful observer will not note the slightest difference between the individuals of the two factions. Yet they do infallibly distinguish between the parties, recognizing at once members of their own formicary and with equal certainty those of the enemy. While watching an ant battle, we will frequently observe individuals running to and fro, challenging all whom they meet by their antennæ, which are kept in a continual motion, the tips describing parabola and circles. At the meeting these organs touch and embrace the face; if the parties be friends they pass on, if foes they straightway interlock mandibles and "fall to." Here one will see many scores of ants struggling together in a heap that is chaos to mortal eyes, but which seems to the emmet senses to present no difficulties in the way of recognition. Smaller groups are scattered over the battle-field; these are often aggregated as follows: two individuals in conflict are joined by a third, who applies her antennæ, distinguishes the enemy, and falls upon her. A fourth, fifth, many other ants, will sometimes thus be found massed upon one poor warrior, who is literally being torn limb from limb. Other groups are composed of several members of one faction and many of another. There are frequent instances of single combats, particularly on the margin of the battle-field, but toward the centre of conflict it appears to be quite the fixed habit of these groups to be composed as above. Evidently, anything like chivalry or "fair play" is rejected from the code of emmet honor. In all these cases, however, the power of recognition never seems for a moment to waver or even hesitate.

It occurred to Mr. McCook that this recognition was based upon a certain odor which *in different degrees of intensity* is emitted by the respective factions. Or, which seems less likely, upon the presence in the individuals of the combatants *of two distinct odors*. This degree of odor, or difference in odors, he supposed might be dependent upon some temporary difference in the physical condition, age, or environment of the antagonists. Supposing that there were any basis of truth in this theory, it further occurred to him that the presence of an artificial and alien perfume of sufficient strength to neutralize the distinctive animal odors, or degrees of odor, and environ the combatants with a foreign and common odor, would have the tendency to confuse the ants and disturb or destroy their power of recognition. In which case he conjectured that the result might be their pacification and reconciliation. He therefore made the following tests:—

First, he collected a number of combatants from a battle being fought upon a flower-border, close to a fence, at his residence, and placed them together in a glass jar upon some soil. He shook the jar quite vigorously several times, so that, if possible, the mechanical agitation might separate the combatants. The ants emerged from the soil to continue or to recommence their fight. When the surface of the earth was well covered with them, and the battle was again at its height, he introduced into the jar a pellet of paper saturated with cologne water. The effect was instantaneous. The ants showed no signs of pain, displeasure, or intoxication. Indeed, some ran freely over the paper. But in a very few seconds the warriors had unclasped mandibles, released their hold of enemies' legs, antennæ, and bodies, and after a momentary confusion began to burrow galleries in the earth with the utmost harmony. On the part of some there was the appearance of thus escaping from the artificial odor; but there was no renewal of the battle. The quondam foes dwelt together for several days in absolute unity and fraternity, amicably feeding, burrowing, and building. Thus the perfume of the cologne proved an eminent pacificator of the contending emmets, and so far verified the theory.

A second experiment was tried in another glass jar, with like result. There was one exception, two ants continuing to fight after the cologne had been introduced. After closer examination Mr. McCook found that one of them was nearly dead, and was holding fast an antenna of her enemy with a death grip, from which escape was impossible. Three days after this he decanted the contents of this jar, ants and soil, into jar No. 1, and the two parties fraternized completely.

A third experiment was made. A large number of the warring ants had been lifted into a box, partly filled with soil, which communicated by a glass tube with a smaller box. The larger box was about ten inches long and eight inches in depth and width; both boxes had sliding glass covers. The original purpose was to observe the battle at leisure, determine how long the creatures would fight, and also if eventually the parties might not separate and the defeated retreat to the smaller box. However, he concluded to follow up the above observations, and abandoning his first purpose, introduced cologne as before into that end of the box in which the combatants were principally engaged. The same effect followed. In less than two minutes every sign of hostility had ceased, except in the case of two pairs, in that end of the box, and of one small group and two single combatants in the opposite end. The two pairs proved to be in conditions similar to the exception above noted, and a small pellet of perfumed paper dropped in the opposite end of the box, dispersed the warriors there. Previous to this, occasional stragglers had passed along the connecting glass tube into the smaller box. Most of them seemed to be of one faction, only one of the opposition having entered, upon whom six or eight ants were expending their wrath. This was the only remaining centre of strife, when Mr. McCook replaced ants and earth upon their native territory. The battle was continuing there, between greatly diminished numbers of course, after the removal of the large battalions into the box, but the application of a feather dipped in cologne to the neighborhood of the warriors caused the instant cessation of controversy. The next day there were no ants found upon the surface, but digging two inches under ground, close by the fence, he observed a few. The battle was evidently over. There had been in the mean time a great change of temperature, from 96° Fahr. to 47°, and this may have had some effect in sending the ants underground.

Attention was next directed to our large Pennsylvania Carpenter ant (*Camponotus Pennsylvanicus*), and a series of experiments made of the same nature as the above. In his study was an artificial formicary of those insects, which had been sent to him from the Allegheny Mountains. The ants had been taken from a branch of an oak tree in mid-winter, and were sent frozen up within a section of the formicary. This section was about one foot in length and seven inches in diameter. The most of the ants were removed from the nest and placed in a glass bottle, to all appearance quite dead. On entering his study the following morning, Mr. McCook was surprised to find that the ants had revived in the heat of the room, had cut a clean tubular hole through the cork, and were crawling over the top and sides of the bottle, just ready for an emigration. They were deposited in a large glass jar, and were the subjects of various experiments, until the death of the queen, eight months thereafter. Among these were the following, by way of further testing the theory above stated concerning the recognition of alien ants. First, Mr. McCook placed in the formicary, which at the time consisted of a piece of the original branch-nest planted upon several inches of soil, some individuals of the same species taken from the trees in Logan Square, Philadelphia. These were instantly attacked, and were beheaded, that being the favorite mode of dealing with enemies among these Pennsylvania Camponoti. Individuals (still alien but of the same species) were then thoroughly covered with the perfume of cologne and put into the formicary. They, too, suffered decapitation. Individuals were now taken from members of the formicary, subjected to the cologne fumigation, and restored to the nest. They were welcomed home unharmed. The whole formicary was then strongly perfumed by means of cotton pellets soaked in cologne, and alien ants of the same species (from Logan Square), which had been treated in the same way, were put into the midst of their mountain congeners. The result which had followed in the previous experiments, appeared once more. The intruders were not attacked with quite the same promptness, but in the end they were brought to the mandiblar guillotine, and their carcasses deposited in or rather on the cemetery which these insects are nearly always sure to establish when there are numerous deaths among them or on their premises. Thus the results of these experiments upon the mode of recognition among ants of *C. Pennsylvanicus*, point to a conclusion directly the reverse of that indicated by similar observations with *Tetramorium cœspitum.* Mr. McCook hopes when a favorable opportunity again presents to continue this line of observations. The results are put on record, inconclusive as they appear, not only because they seem to be in themselves interesting and valuable, but in order to stimulate inquiry among others in the same direction, and to invite suggestions and information which other observers may be able to make.

Dr. C. N. Peirce was elected a member of the Council in place of Dr. R. S. Kenderdine elected Curator.

Messrs. S. Fisher Corlies and Clarence S. Bement wêre elected members of the Finance Committee.

Griffith E. Abbot, George Wolf Holstein, Frank H. Rosengarten, John K. Valentine, James Huneker, Albert H. Smith, M.D., John A. Ryder, and Charlotte Uhlen Olsen, M.D., were elected members.

The following were elected Correspondents: John McCrady of Sewanee, Tenn., Charles T. Minot of Roslindale, Mass., Henry Hicks of London, J. W. Hulke of London, Thomas Belt of London, H. G. Seeley of London, W. T. Thistleton Dyer of London, Archibald Geikie of Edinburgh, James Geikie of Edinburgh, Charles Barrois of Lille, M. E. Jannettaz of Paris, Emil Sauvage of Paris, Ch. Velain of Paris, Edmond Pellat of Paris, H. Filhol of Paris, Michael Vacek of Vienna, and Karl von Seebach of Göttingen.

The following papers were ordered to be printed :—